

CLAIMS

What is claimed is:

1. A hybrid motor vehicle, comprising:
 - an engine having a rotary output;
 - a transmission having a rotary input and a rotary output connected to a first axle assembly having a first pair of wheels;
 - a first clutch for selectively coupling said engine output to said transmission input for providing driving torque to said first pair of wheels;
 - an electric motor having a rotary member connected to a second axle assembly having a second pair of wheels;
 - a transfer unit driven by said engine output;
 - a second clutch for selectively coupling said transfer unit to said rotary member of said electric motor; and
 - a hybrid control unit for controlling selective actuation of said electric motor and said first and second clutches.

2. The hybrid motor vehicle of Claim 1 further comprising:
an engine control unit for controlling operation of said engine; and
a transmission control unit for controlling shifting of said transmission so as to establish various speed ratio drive connections between said transmission input and said transmission output, said hybrid control unit communicating with said engine control unit and said transmission control unit to establish an electric drive mode and an engine drive mode.

3. The hybrid motor vehicle of Claim 2 wherein said first clutch is engaged and said second clutch is released during said engine drive mode such that said engine delivers drive torque through said transmission to said first pair of wheels.

4. The hybrid motor vehicle of Claim 3 wherein said rotary member of said electric motor is selectively driven by said second axle assembly during said engine drive mode for driving said electric motor as a generator.

5. The hybrid motor vehicle of Claim 2 wherein said first clutch is released and said second clutch is engaged during said electric drive mode such that said electric motor drives said rotary member for delivering drive torque to said second pair of wheels.

6. The hybrid motor vehicle of Claim 1 further comprising a third clutch for selectively coupling said rotary member of said electric motor to said second axle assembly, and wherein said hybrid control unit is operable to control actuation of said third clutch.

7. The hybrid motor vehicle of Claim 6 wherein said first clutch is engaged and said second and third clutches are released during an engine drive mode for providing drive torque to said first pair of wheels.

8. The hybrid motor vehicle of Claim 7 wherein said second clutch can be selectively engaged during said engine drive mode for driving said rotary member of said electric motor such that said electric motor functions as a generator for charging a battery.

9. The hybrid motor vehicle of Claim 6 wherein said first and second clutches are released, said third clutch is engaged and said electric motor is activated during an electric motor drive mode such that said electric motor provides driving torque to said second pair of wheels.

10. The hybrid motor vehicle of Claim 6 wherein said first and third clutches are engaged and said second clutch is released during a hybrid engine and electric motor drive mode such that said engine provides drive torque to said first wheels and said electric motor provides drive torque to said second wheels.

11. The hybrid motor vehicle of Claim 6 wherein said second axle assembly includes a differential connected to said rotary member of said electric motor for driving a pair of drive axles, and wherein said third clutch includes a pair of clutches for selectively connecting each of said drive axles to a corresponding one of said second pair of wheels.

12. The hybrid motor vehicle of Claim 6 wherein said second axle assembly includes a differential and a pair of drive axles connecting said second pair of wheels to said differential, and wherein said third clutch is operable for selectively coupling said rotary member of said electric motor to said differential.

13. A four-wheel drive hybrid vehicle, comprising:

- a first pair of wheels;
- a second pair of wheels;
- an engine;
- a power transfer unit driven by said engine;
- a first clutch for selectively connecting said engine to said first pair of wheels;
- an electric motor;
- a second clutch for selectively connecting said power transfer unit to said electric motor; and
- a third clutch for selectively connecting said electric motor to said second pair of wheels.

14. The four-wheel drive hybrid vehicle of Claim 13 wherein said first clutch is engaged and said third clutch is released during an engine drive mode.

15. The four-wheel drive hybrid vehicle of Claim 14 wherein said second clutch may be engaged during said engine drive mode for driving said electric motor as a generator to charge a battery.

16. The four-wheel drive hybrid vehicle of Claim 13 wherein said first and second clutches are released and said third clutch is engaged during an electric drive mode such that said electric motor provides drive torque to said second pair of wheels.

17. The four-wheel drive hybrid vehicle of Claim 13 wherein said first and third clutches are engaged and said second clutch is released during a hybrid combined engine and motor drive mode such that said engine provides drive torque to said first pair of wheels and said electric motor provides drive torque to said second pair of wheels.

18. The four-wheel drive hybrid vehicle of Claim 13 further comprising a control unit for controlling operation of said engine, said electric motor and said first, second and third clutches.

19. The four-wheel drive hybrid vehicle of Claim 13 further comprising a transmission that is drivingly connected to said first pair of wheels, and wherein said first clutch is operable for selectively connecting said engine to said transmission.

20. The four-wheel drive hybrid vehicle of Claim 13 further comprising a differential driven by said motor and a pair of driveshafts driven by said differential, and wherein said third clutch includes a pair of clutches operable for selectively coupling each of said driveshafts to a corresponding one of said second pair of wheels.

21. The four-wheel drive hybrid vehicle of Claim 13 further comprising an axle assembly interconnecting said second pair of wheels, and wherein said third clutch is operable for selectively connecting said electric motor to said axle assembly.

22. A hybrid drive system, comprising

- an engine;
- a power transfer unit driven by said engine;
- a first axle assembly driven by said engine for providing drive torque to a first pair of wheels;
- an electric motor;
- a first clutch for selectively connecting said power transfer unit to said electric motor;
- a second axle assembly having a second pair of wheels;
- a second clutch for adaptively transferring drive torque from said electric motor to said second axle assembly; and
- a control unit for controlling operation of said engine and said electric motor and selective actuation of said first and second clutches.

23. The hybrid drive system of Claim 22 further comprising a transmission driving said first axle assembly and a third clutch for selectively coupling said engine to said transmission, and wherein said control unit controls actuation of said third clutch.

24. The hybrid drive system of Claim 22 wherein said electric motor has a rotary motor shaft, wherein said first clutch is operable for selectively coupling said power transfer unit to said motor shaft, and wherein said second clutch is operable for transferring drive torque from said motor shaft to said second axle assembly.

25. A hybrid drive system, comprising:
an engine;
a power transfer unit driven by said engine;
an electric motor selectively driven by said power transfer unit;
a first axle assembly including an active clutch system for selectively applying drive torque from said electric motor to a first pair of drive wheels; and
a second axle assembly driven by said engine for providing drive torque to a second pair of drive wheels.

26. The hybrid drive system according to Claim 25, further comprising a control unit for controlling said engine, said electric motor, said power transfer unit and said active clutch system.

27. The hybrid drive system according to Claim 25, wherein said active clutch system includes a pair of active clutches for applying torque to said first pair of drive wheels.

28. The hybrid drive system according to Claim 25, wherein said active clutch system includes at least one active clutch for applying torque to said first pair of drive wheels.

29. The hybrid drive system according to Claim 25, wherein said power transfer unit includes a controllable clutch unit operable in a released mode to uncouple said electric motor from said power transfer unit and in an engaged mode to couple said electric motor to said power transfer unit.